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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/730,982

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Atuhito Mochida

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EXAMINER

STONER, KILEY SHAWN

ART UNIT

PAPER NUMBER

1725

MAIL DATE

DELIVERY MODE

09/18/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/730,982

Applicant(s)

MOCHIDA ET AL.

Examiner

Kiley Stoner

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 11 May 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 18-34 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 18-23, 25, 27, 28, 30, 31, 33 and 34 is/are rejected.
- 7) ☒ Claim(s) 24, 26, 29 and 32 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

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 9/5/07

Kiley Stoner

Primary Examiner A.U. 1725

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. **Claims 18-22, 30 and 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hawrylo (USPN 4576326).**

Hawrylo teaches a method of mounting a semiconductor component by heating a bonding member (14) on a submount (12) on a heating table and positioning the component which is heated and pressed by a collet (thermocompression tool) on the submount with pressure (figures 1, 4, col 1 lines 9-45, col 2 line 60 – col 3 line 27). The collet and table are heated to an appropriate temperature (col 4 lines 15-25) however the temperatures are not further disclosed. Neither is keeping heat from the heating table away of the collet or releasing the device before complete solidification.

It would have been obvious to one of ordinary skill in the art at the time of the invention to control heating of both the collet and table during each phase of bonding to prevent thermal damage to the devices. During placement heating both to the same temperature will prevent warping. As the heating table comprises a heatsink (12) most heat will stay below the collet and be drawn to the sink. It is unlikely that heat would

flow upward to the collet when there is heatsink present and the tool has its own heat source. By releasing the device prior to complete solidification the part can align itself without risk of damage due to collet pressure.

3. Claims 23, 25, 31 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hawrylo (USPN 4576326) as applied to claims 18-22 and 30 above, and further in view of Powers et al. (US 2004/0195297 A1).

Hawrylo teaches a method of mounting a semiconductor component by heating a bonding member (14) on a submount (12) on a heating table and positioning the component which is heated and pressed by a collet (thermocompression tool) on the submount with pressure (figures 1, 4, col 1 lines 9-45, col 2 line 60 – col 3 line 27). The collet and table are heated to an appropriate temperature (col 4 lines 15-25).

However the bonding member is not further disclosed.

Powers teaches bonding a semiconductor component with a bonding material comprising at least two elements having different fusing points, including Au/Sn and In, wherein the component is held in place until solidified (paragraphs 10 and 19-21).

It would have been obvious to one of ordinary skill in the art at the time of the invention to make the bonding pads of a lead free solder with at least two metals with different fusing points or a material with a melting point less than eutectic solder to provide reliable, environmentally safe, bonds over a narrow temperature range thereby avoiding damage to the component and substrate.

4. Claim 27 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hawrylo (USPN 4576326) as applied to claims 18-22 and 30 above, and further in view of Kurpiela (USPN 5579979).

Hawrylo teaches a method of mounting a semiconductor component by heating a bonding member (14) on a submount (12) on a heating table and positioning the component which is heated and pressed by a collet (thermocompression tool) on the submount with pressure (figures 1, 4, col 1 lines 9-45, col 2 line 60 – col 3 line 27). The collet and table are heated to an appropriate temperature (col 4 lines 15-25).

However although the collet has a larger portion, a larger contacting side is not disclosed.

Kurpiela teaches a soldering collet comprising a large contacting side (figure 2 and col 2 lines 45-61).

It would have been obvious to one of ordinary skill in the art at the time of the invention to employ a collet with a larger contacting side to facilitate rework and that the collect contact area is relative to the size of the component being attached at the time and can change when different components are bonded.

5. Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hawrylo (USPN 4576326) as applied to claims 18-22 and 30 above, and further in view of Laub et al. (USPN 3790738).

Hawrylo teaches a method of mounting a semiconductor component by heating a bonding member (14) on a submount (12) on a heating table and positioning the

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component which is heated and pressed by a collet (thermocompression tool) on the submount with pressure (figures 1, 4, col 1 lines 9-45, col 2 line 60 – col 3 line 27). The collet and table are heated to an appropriate temperature (col 4 lines 15-25).

However the collet material is not disclosed.

Laub teaches a semiconductor bonding method using a low conductivity collet (col 3 lines 35-59 and col 4 lines 5-35) with temperature control (col 7 line 58 – col 8 line 4).

It would have been obvious to one of ordinary skill in the art at the time of the invention to employ a low conductivity collet to prevent thermal damage to the devices.

Response to Arguments

6. Applicant's arguments filed 5/11/07 have been fully considered but they are not persuasive.

The applicant states:

“[t]he Examiner makes the statement that 'during placement heating both to the same temperature will prevent warping'. While accurate, the only source for this statement is the present invention.”

The examiner respectfully disagrees. It is extremely well known in the art that creating a temperature differential in an article will introduce stress into the article, and if the stress is significant enough the article will become warped. Thus, at the time of the invention it would have been obvious to one of ordinary skill in the art to control the temperature differential during the heating process to the extent that the article does not become warped. Accordingly, it is obvious to one of ordinary skill in that art that if both

sides of the article are heated at the same temperature there will be a minimal temperature differential. This will result in a limited amount of stress being introduced into the article and prevent the article from warping. Evidence that this concept is well known in the art is provided by U.S. 3,617,682, where it is taught that the temperature of the collet and the heater block are both set to approximately 300°C (note column 1, line 63-column 2, line 4; column 2, lines 65-69; column 3, lines 7-9; and column 4, lines 11-17).

The applicant also argues that:

“Hawrylo does not provide any disclosure or suggestion of carrying out the pressure bonding operation so as to substantially prevent the transfer of heat from the component to the collet. Hawrylo does not even recognize the problems associated with temperature differences in the component (i.e. generation of residual stress in the component).”

Even though Hawrylo is silent with respect to preventing the transfer of heat from the component to the collet, it is the examiner's position that a substantial amount of heat would not transfer from the component into the collet during the process of Hawrylo. The applicant has failed to provide a persuasive argument or any evidence that a substantial amount of heat would transfer from the component to the collet during the process of Hawrylo. In addition, when heating both sides of the article to the same temperature, which is clearly obvious, there would not be a substantial amount of heat transfer from the component into the collet.

With respect to claim 20, it is well known in the art that depending on the components being bonded together it is sometimes desirable to heat the collet to a higher temperature than that of the heating table in order to control warpage. Thus, it is

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the examiner's position that the limitation that the collet is maintained at a temperature higher than the temperature of the heating table until the bonding member solidifies completely is obvious to one of ordinary skill in the art. Evidence that this concept is well known in the art is provided by U.S. 5,425,491, where it is taught to heat the stage to at most 200°C and heating the bonding tool to 600 to 650°C (column 6, lines 14-45). Heat transfer flows in one direction from the hotter object into the colder object. Accordingly, when the collet is hotter than the heating stage heat will not transfer back into the collet.

With respect to claim 21, it is well known to preheat a component prior to bonding in order to reduce stress and increase the speed of the bonding process. In the art of semiconductor bonding it is highly desirable to reduce the bonding time in order to insure that the components are not thermally damaged.

Applicant also argues:

“[T]o establish prima facie obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. In re Royka, 490 F.2d 981, 180 USPQ 580 (Fed.Cir 1974). In this case, none of the limitations of claims 19-21 are disclosed in the prior art.”

According to the Supreme Court, the teaching, suggestion, or motivation test (TSM test) is one of a number of valid rationales that could be used to determine obviousness. It is not the only rationale that may be relied upon to support a conclusion of obviousness. (*KSR International Co. v. Teleflex Inc.*, 82 USPQ2d 1385 (2007)).

The claim would have been obvious because a particular known technique was recognized as part of the ordinary capabilities of one skilled in the art. Additionally, the claim would have been obvious because “a person of ordinary skill has good reason to

pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense.” For the reasons set forth above, it is the examiner’s position that the limitations of claims 19-21 are obvious to one of ordinary skill in the art. (KSR International Co. v. Teleflex INC, 82 USPQ2d 1385 (2007)).

Even through Hawrylo teaches that the heating means in the collet is optional, the citation pointed out by the applicant is still a positive teaching that the collet may contain a heating means. In order for heat to be transferred into the collet the temperature of the heating stage would have to be substantially greater than the temperature of the collet. Since the temperature of the heating stage and collet in Hawrylo are not disclosed the examiner cannot come to this conclusion. It should further be noted that even if the temperature of the heating stage was significantly greater than the temperature of the collet the component would have to be heated for a significant amount of time to actually transfer heat from the component into the collet. One of ordinary skill in the art would not heat a component for such an extended period of time due to the risk of thermal degradation. Thus, the examiner maintains that the pressure bonding method of Hawrylo substantially prevents the transfer of heat from the component into the collet.

Allowable Subject Matter

7. Claims 24, 26, 29 and 32 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kiley Stoner whose telephone number is 571-272-1183. The examiner can normally be reached Monday-Thursday (9:30 a.m. to 8:00 p.m.).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jonathan Johnson can be reached on 571-272-1177. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a